Domtest project – outline and status

Instrumentation workshop LBNL
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TestDAQ Section

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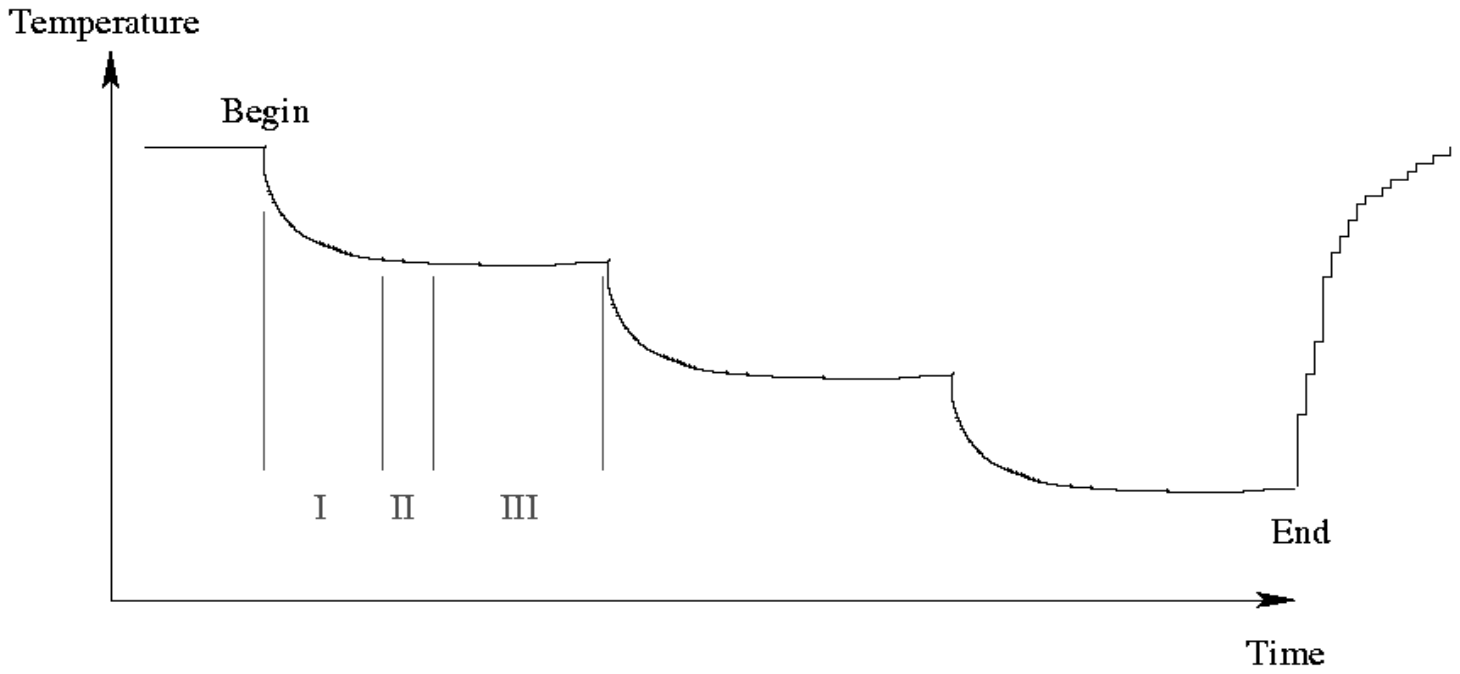
Outline

- DOM testing sequence:
  Interaction of DAQ-Control and analysis
- How domtests work
- More about tools

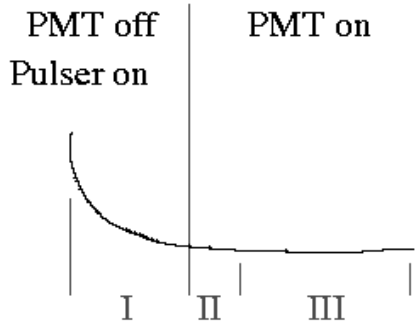
A fixed sequence is repeated for each temperature step.

Ramp temperature down, measure (I, II, III)

and repeat...

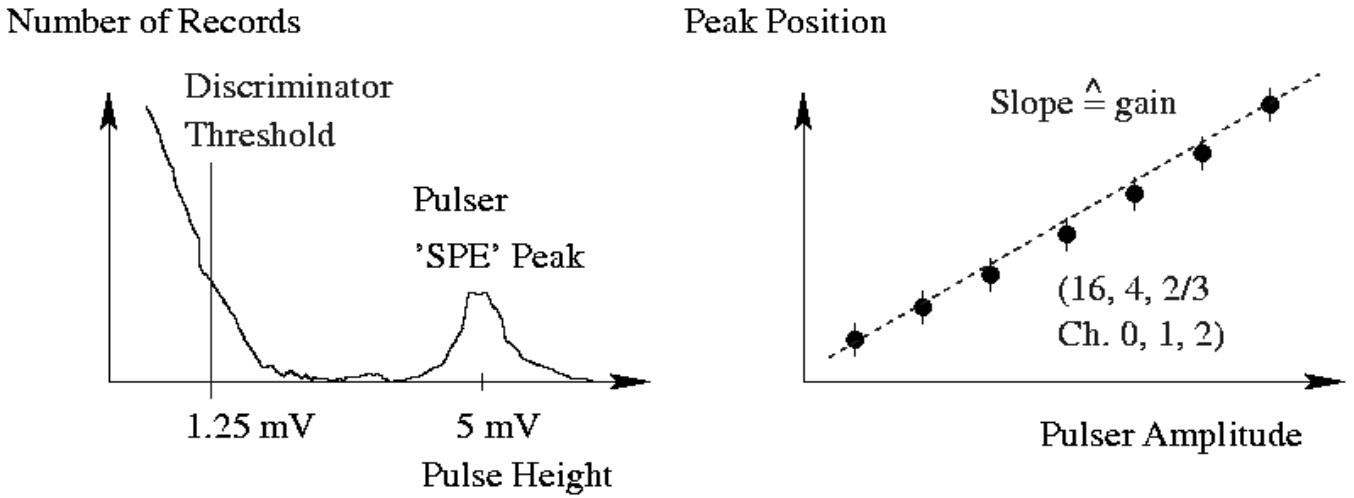


In the freezer data recording is alwalys on.



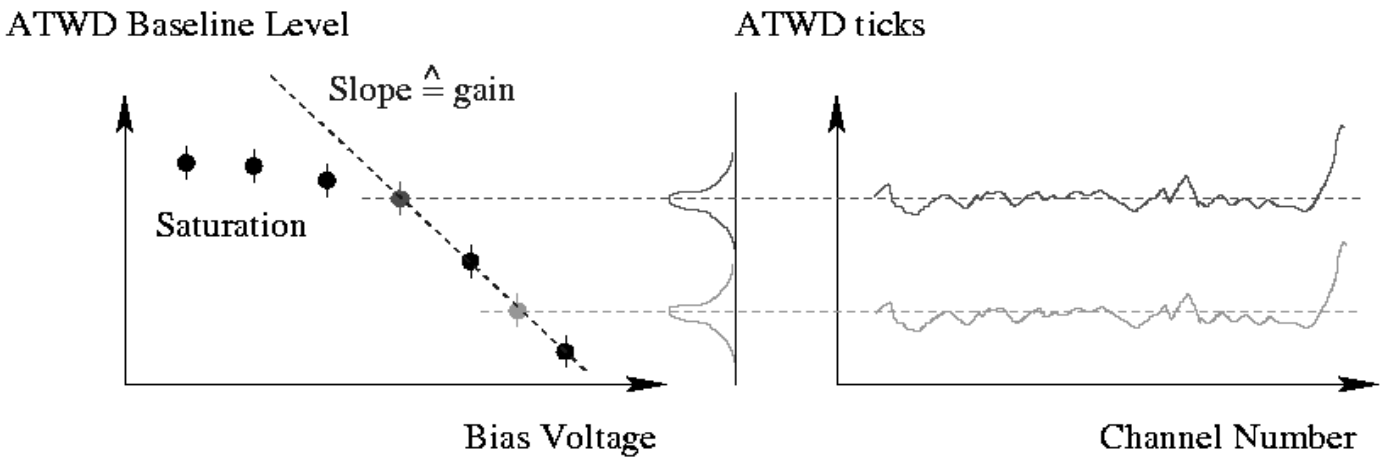
- I: Set target Temperature, wait for stabilisation
- II: Analyse data from section I, apply result. Determine nominal HV, apply.
- III: All other measurements with nominal settings.

In part I the discriminator threshold is determined.



- Set pulser to various amplitudes, including the target SPE value.
- Determine the discriminator threshold and the gain for each DOM.

In part I also the pedestal pattern is examined.



- Collect pedestal patterns at all temperatures
- Study gain per channel
  (see also Kael's talk)

At the end of part I DAQ Control asks the analysis package for the results.

- DAQ Control starts an analysis of the files recorded in part I.
- Results: discriminator threshold and pedestal patterns are immediately applied.

- Next: need nominal HV to continue → Part II

In part II the nominal HV is determined.

- DAQ Control starts a gain-versus-HV run.
- DAQ Control asks the analysis package to determine the nominal HV for the current temperature.

- How this is done → Following slide.

DAQ Control asks for nominal HV settings for each DOM.

- DC specifies all filenames and output directory for the analysis package (xml).
- DC starts the analysis, passing xml as argument.
- Analysis writes (xml) results to output directory.
- DC reads in results and adjusts descriptor xmls for each DOM.
- DC asks all DOMs to re-adjust.

In part III DAQ Control carries out a bunch more tests.

- Linearity tests using LEDs and a reference DOM
- PMT time jitter
- PMT quantum efficiency
- Time synchronisation resolution (RapCal)
- Many more....

- Data get recorded but are analysed only later.

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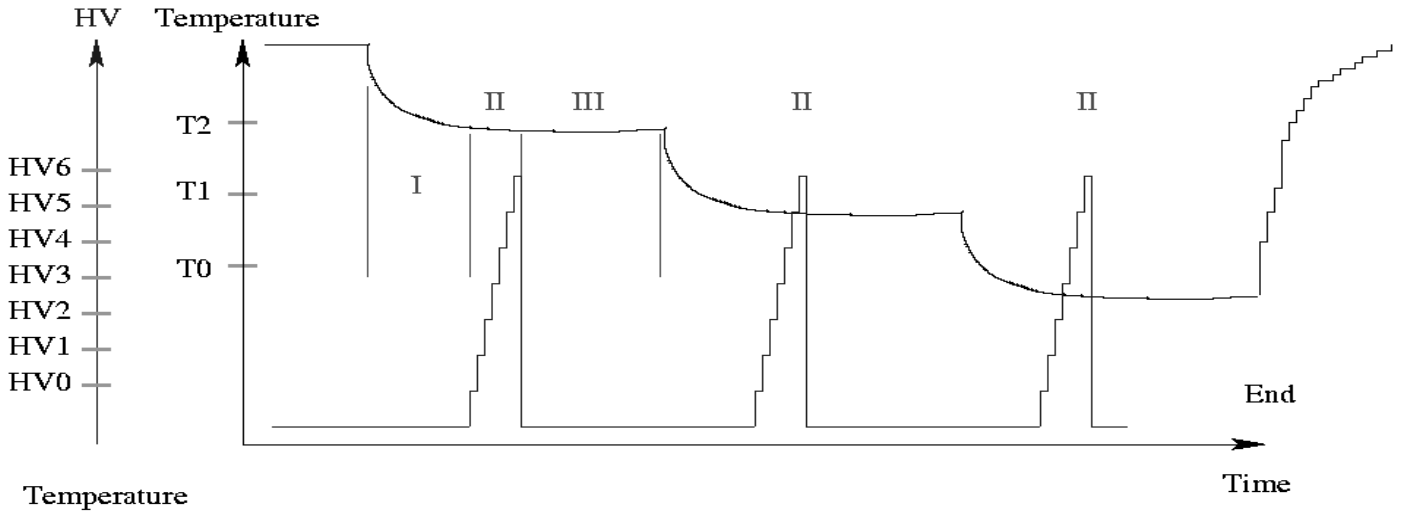
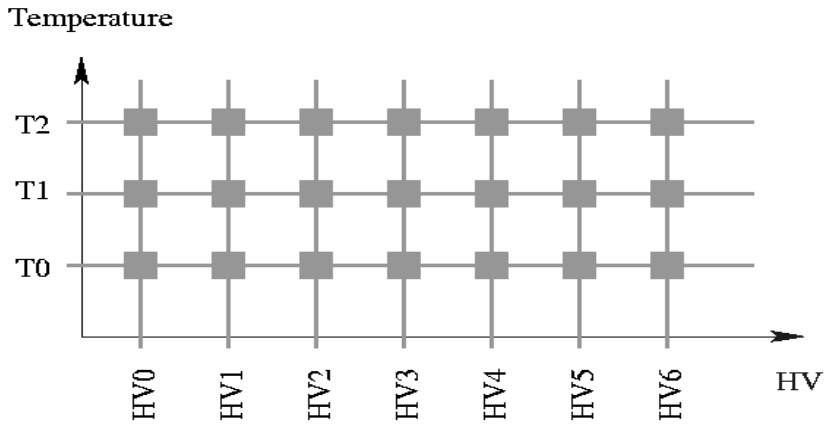
A domest checks a series of files for a specific property.

- Goal: use 10 weeks' data to judge DOM quality.
- Specify (xml):
  - Inputfiles
  - Suitable data subsets
  - Analysis class
  - Judgement class
  - Output directory
- Example:
  - /data/domtest/23July2003/TestDaq_231.zip
    /data/domtest/23July2003/TestDaq_232.zip
  - HV stable
    Temperature stable ⟶ next slide
    Quality good
  - GainVersusHV ⟶ later slide
  - GainVersusHVJudgement ⟶ later slide
  - /data/domtest/23Jul2003/gainVsHV/results

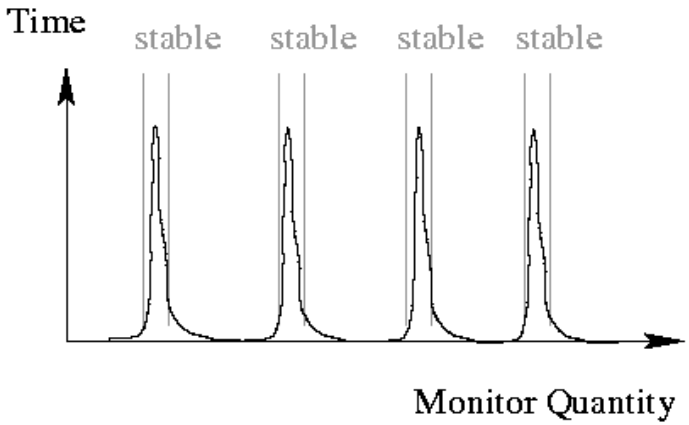
Identify time intervals where Temperature and HV were stable.



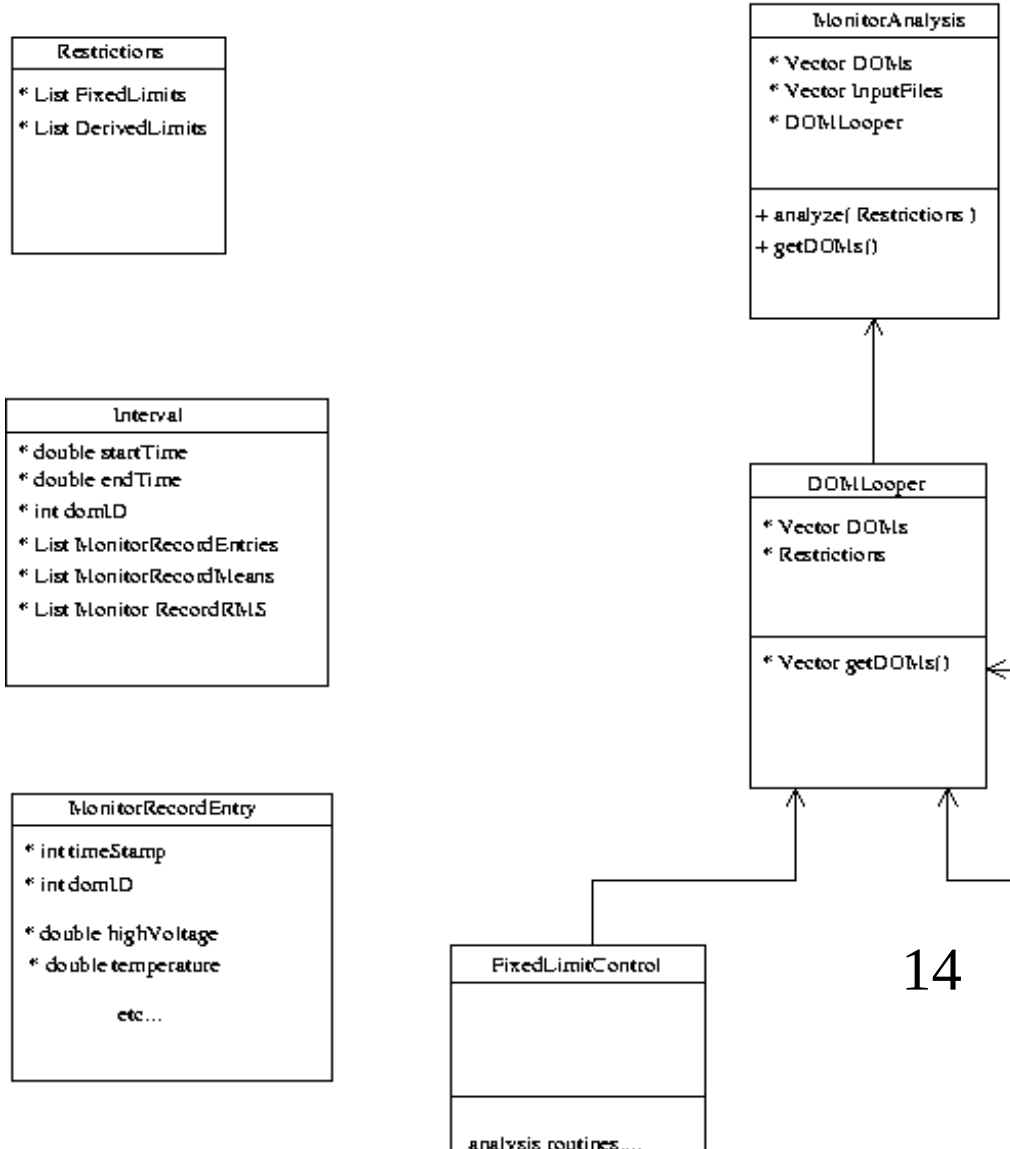


Time intervals are specified e.g. as: 'HV was stable'.

- Fixed limits:
  Value was in range [Low; Hi].
- Derived limits:
  Value was in a peak of time distribution of that quantity.



Monitor Analysis Class Diagram



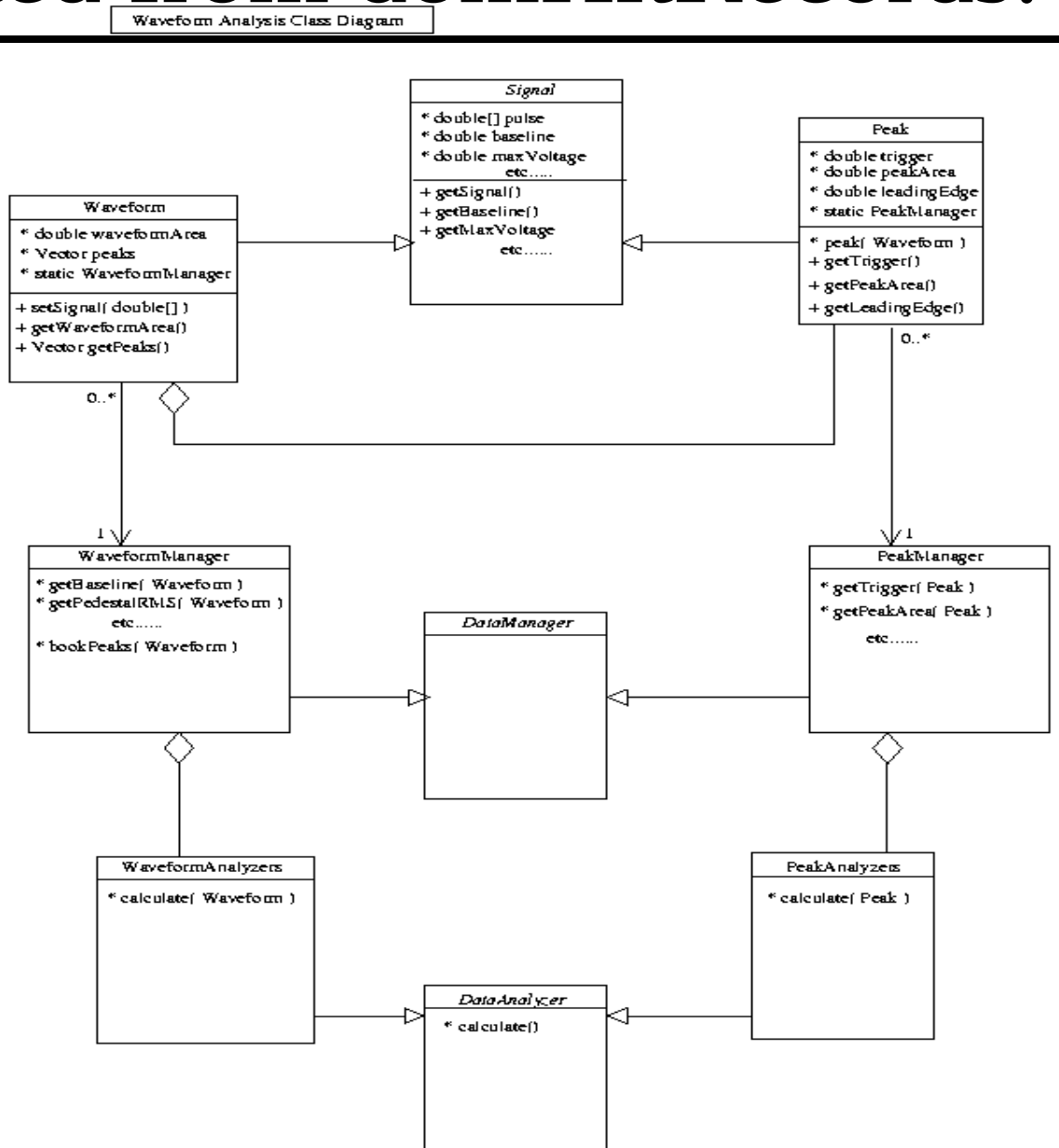
The selected time intervals are stored in an xml file.

```xml
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema">
    <xs:include schemaLocation="MonitorRecordEntry.xsd"/>

    <xs:element name="IntervalGroup">
        <xs:complexType>
            <xs:sequence>
                <xs:element name="TimeIntervals" type="IntervalEntry" maxOccurs="unbounded"/>
                <xs:element name="DACValues" type="DACEntry" maxOccurs="unbounded"/>
            </xs:sequence>
            <xs:attribute name="DomID" type="xs:string" use="required"/>
        </xs:complexType>
    </xs:element>

    <xs:complexType name="IntervalEntry">
        <xs:sequence>
            <xs:element name="MonitorRecordEntry" type="MonitorEntry" maxOccurs="unbounded"/>
        </xs:sequence>
        <xs:attribute name="BeginTime" type="FortyEightBits" use="required"/>
        <xs:attribute name="EndTime" type="FortyEightBits" use="required"/>
    </xs:complexType>

    <xs:complexType name="DACEntry">
        <xs:attribute name="Name" type="xs:string" use="required"/>
        <xs:attribute name="Value" type="xs:double" use="required"/>
    </xs:complexType>

</xs:schema>
```

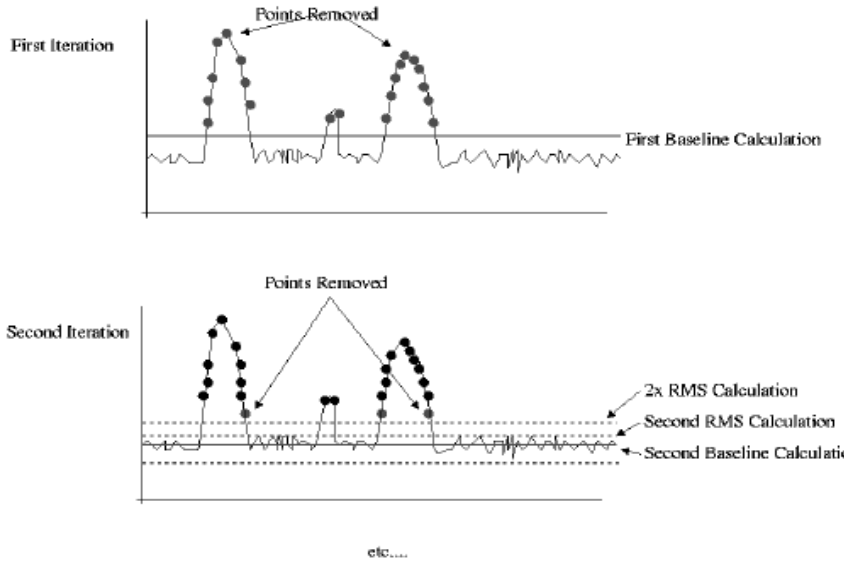
Analysis is only carried out for records within valid time intervals.

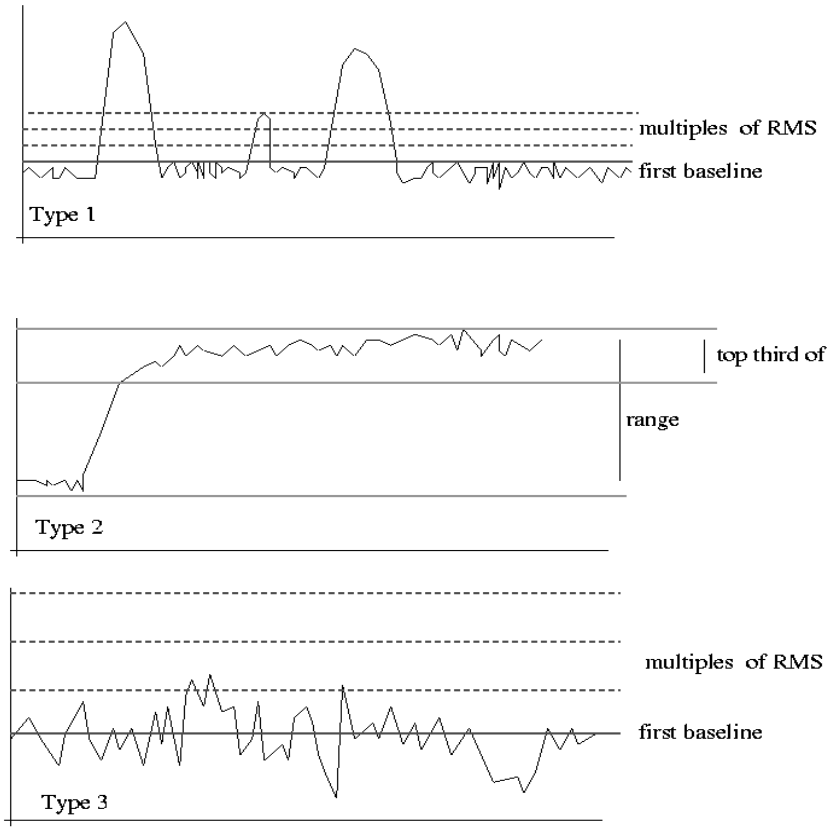
- Book a set of result histograms for all independent time intervals.
  Gain versus HV: find number of temperature intervals.
- Analyse all records from within time intervals.
  Find pulse height and fill pulse-height-spectrum for the right temperature interval.
- Once the loop is finished, call 'finalise' method from the analysis.
  Fit 1/x and Gaussian to pulse-height-spectrum. Find peak position. This is a measure of the PMT gain @ HV (@ Temperature).
- Store the results.

Analysis deals with waveforms extracted from domHitRecords.



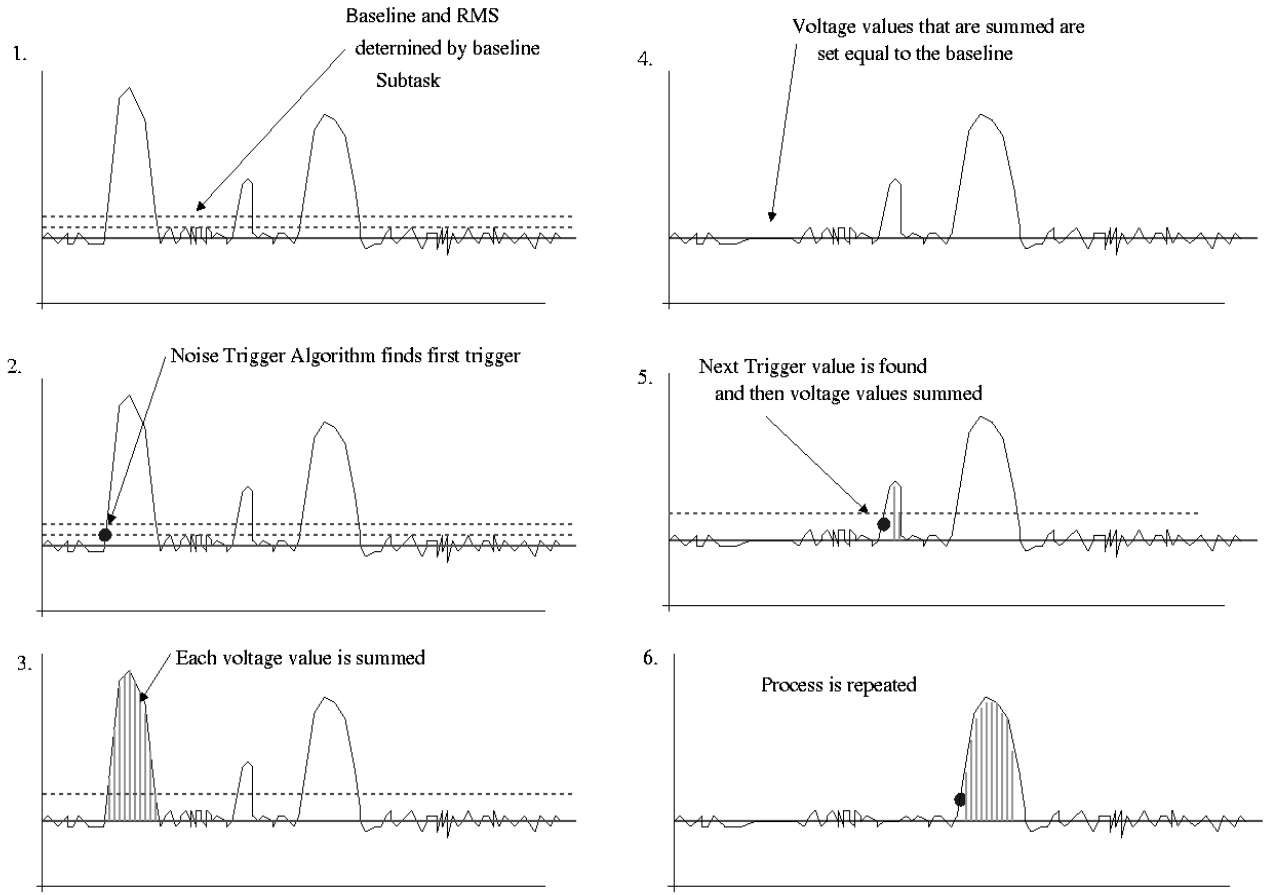
Examples how the waveform analysis works – (1) baseline determination*





(*)Taken from the domtest documentation

Examples how the waveform analysis works – (2) pulse height*



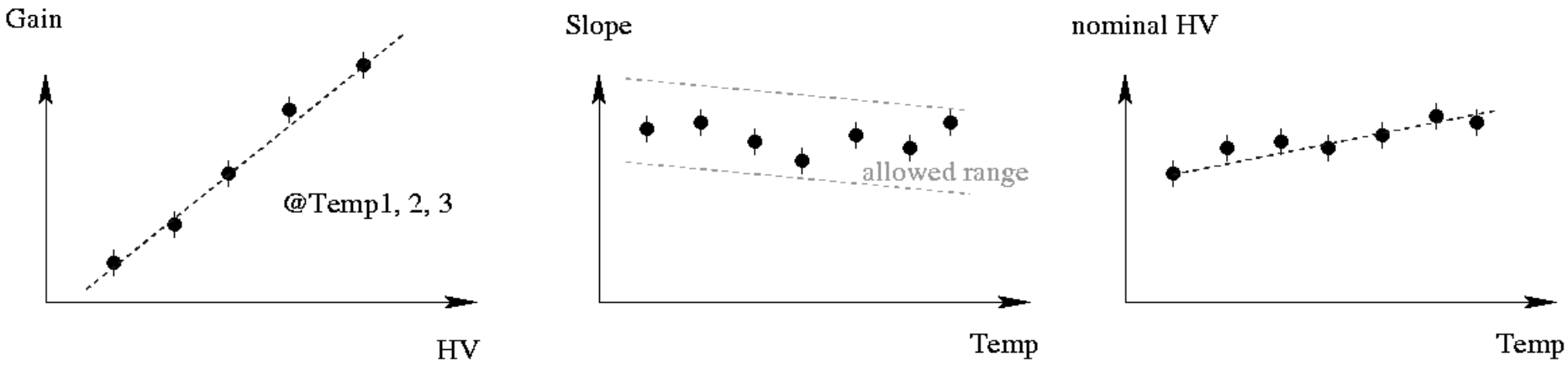
(*)Taken from the domtest documentation

Analysis is only carried out for records within valid time intervals (2).

- Book a set of result histograms for all independent time intervals.
  Gain versus HV: find number of temperature intervals.
- Analyse all records from within time intervals.
  Find pulse height and fill pulse-height-spectrum for the right temperature interval.
- Once the loop is finished, call 'finalise' method from the analysis.
  Fit 1/x and Gaussian to pulse-height-spectrum. Find peak position. This is a measure of the PMT gain @ HV (@ Temperature).
- Store the results.

DOM judgement for the gain versus HV measurement*.

- Read in results from the analysis output.xml file.



- Judge e.g. Chi^2 of distributions with straight lines and cut on their values: pass, fail, incomplete.

(*) Not a terribly good example.

Outline

- DOM testing sequence:
  Interaction of DAQ-Control and analysis
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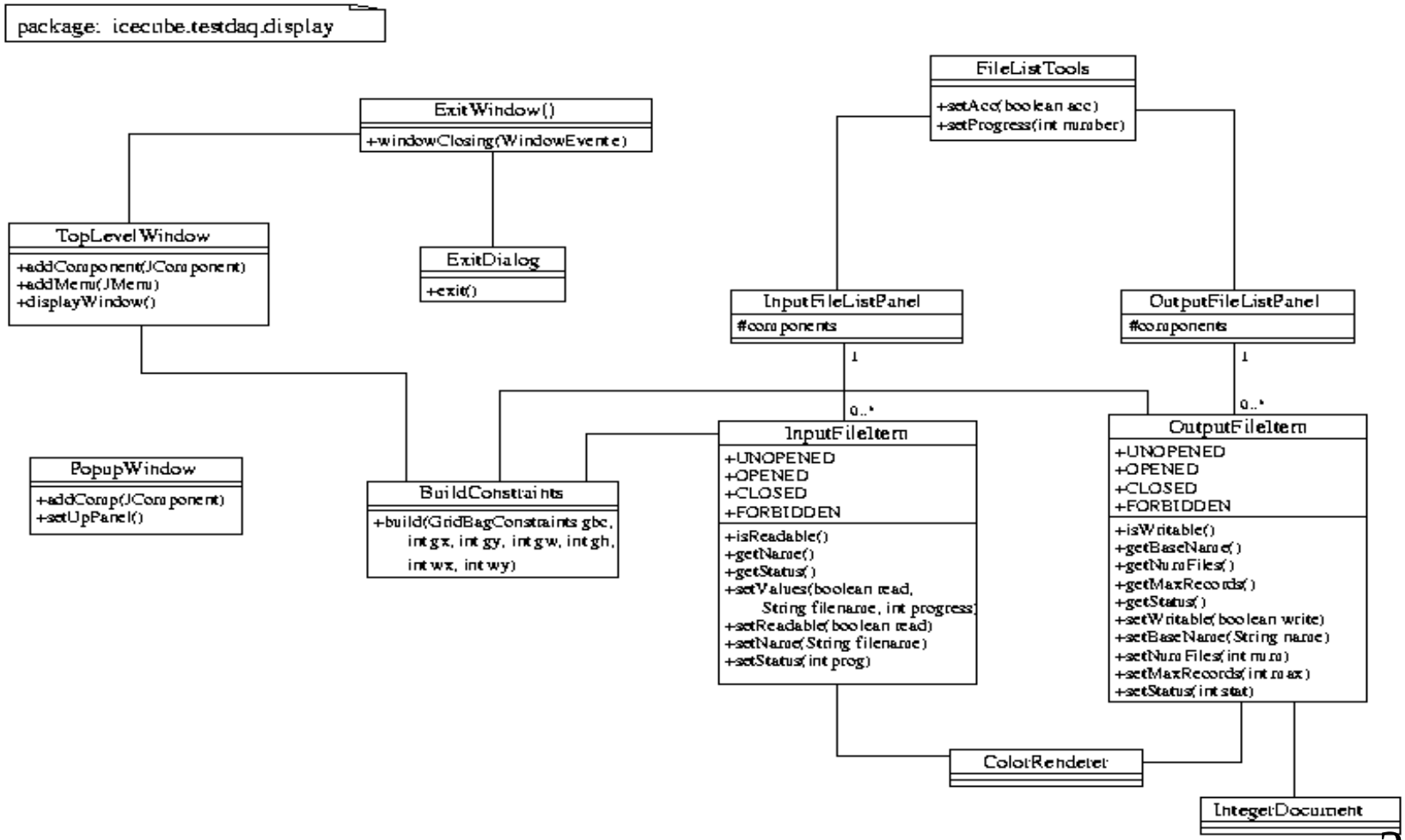
Other tools.

- Display package.
- Oscilloscope and Multi Channel Analyser with monitor value strip chart tool.
- Monitor strip chart as plugin for DAQ Control.
- DOM data simulator: test robustness of analysis with artificial glitches.
- Data reader/writer with data version awareness:

  DomDescriptor (DomConfig), runHeader, domhitRecord, domMonitorRecord, extMonitorRecord, rapCalRecord.

Display package offers help building up graphical displays.

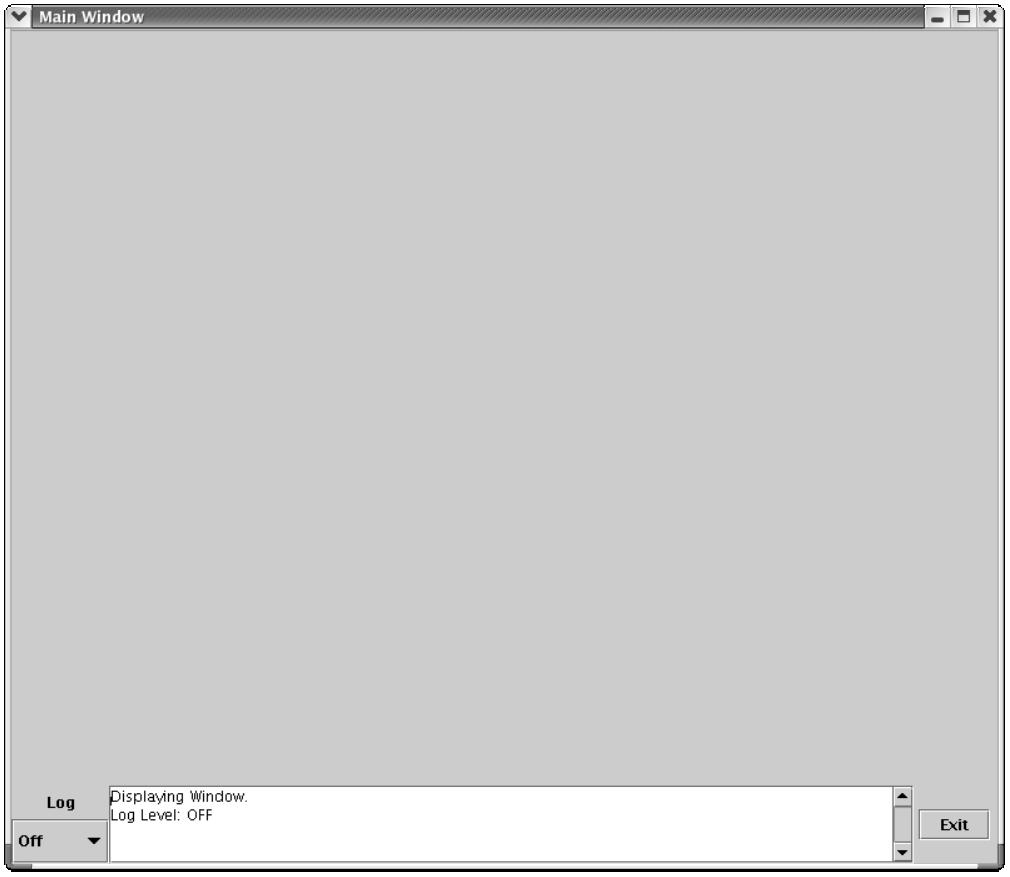


The display package provides a.o. a pre-factured main window.

Constructors:
- TopLevelWindow()
- TopLevelWindow(String title, int length, int width, components, menus)

Methods:
- addComponent(JComponent comp)
- addMenu(JMenu menu)
- displayWindow()

All other packages will use this main window and the logging interface.



The display package provides also a pre-factured popup window.

Constructors:

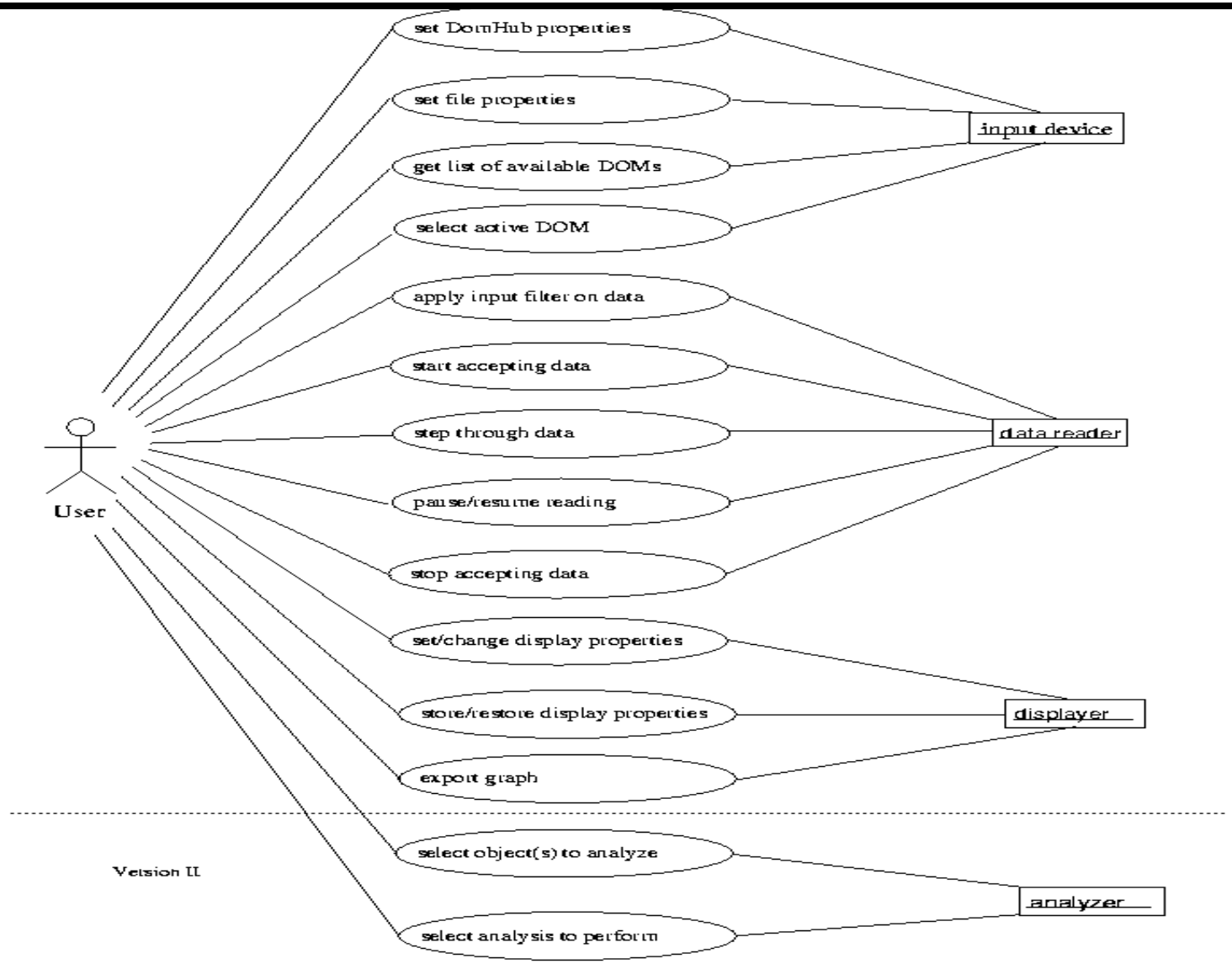
- PopupWindow()
- PopupWindow(String title, int length, int width, components)

Methods:

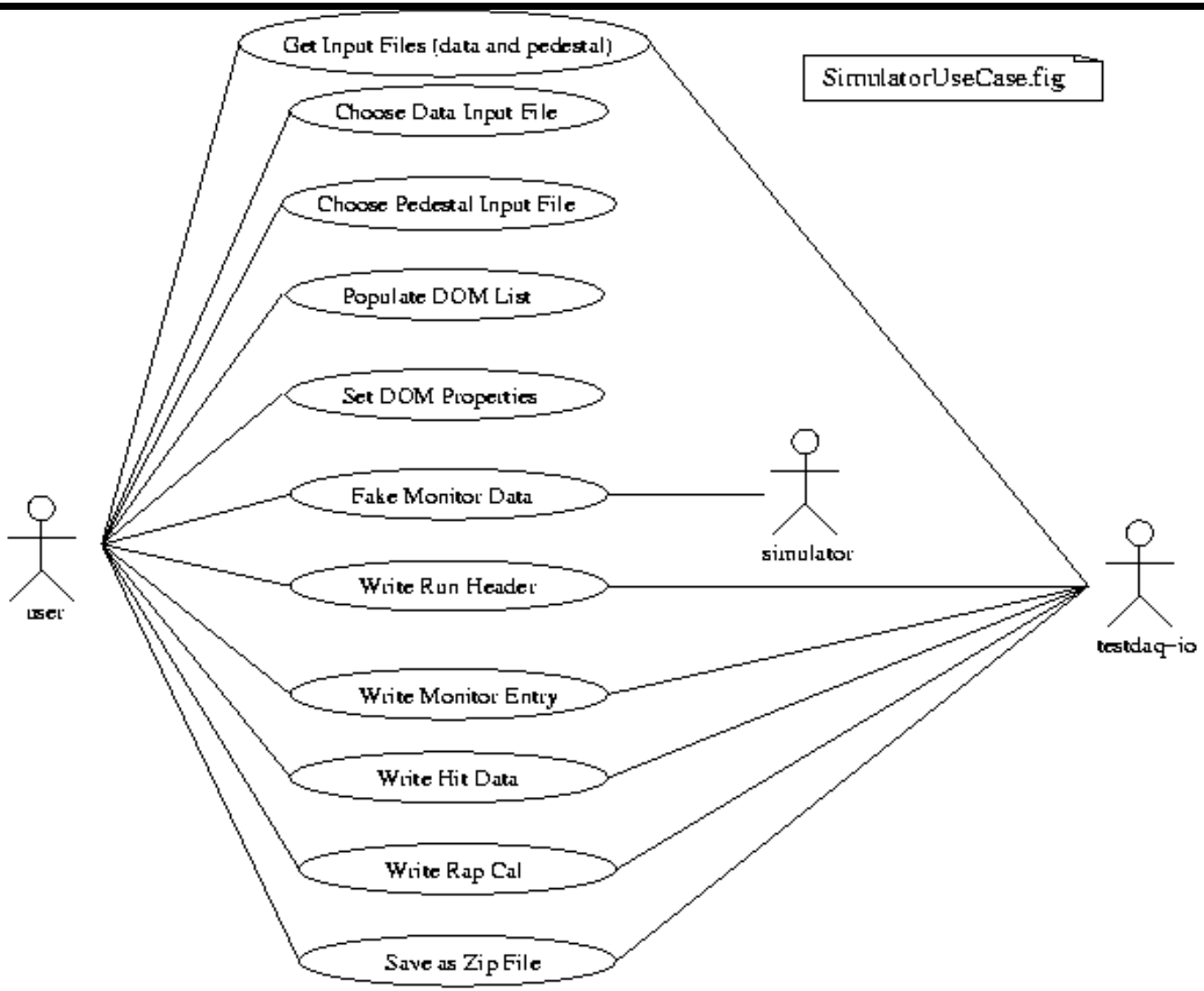
- addComp(JComponent comp)
- setUpPanel()

The popup window is used when only a simple window is needed.

The oscilloscope has four main parts.

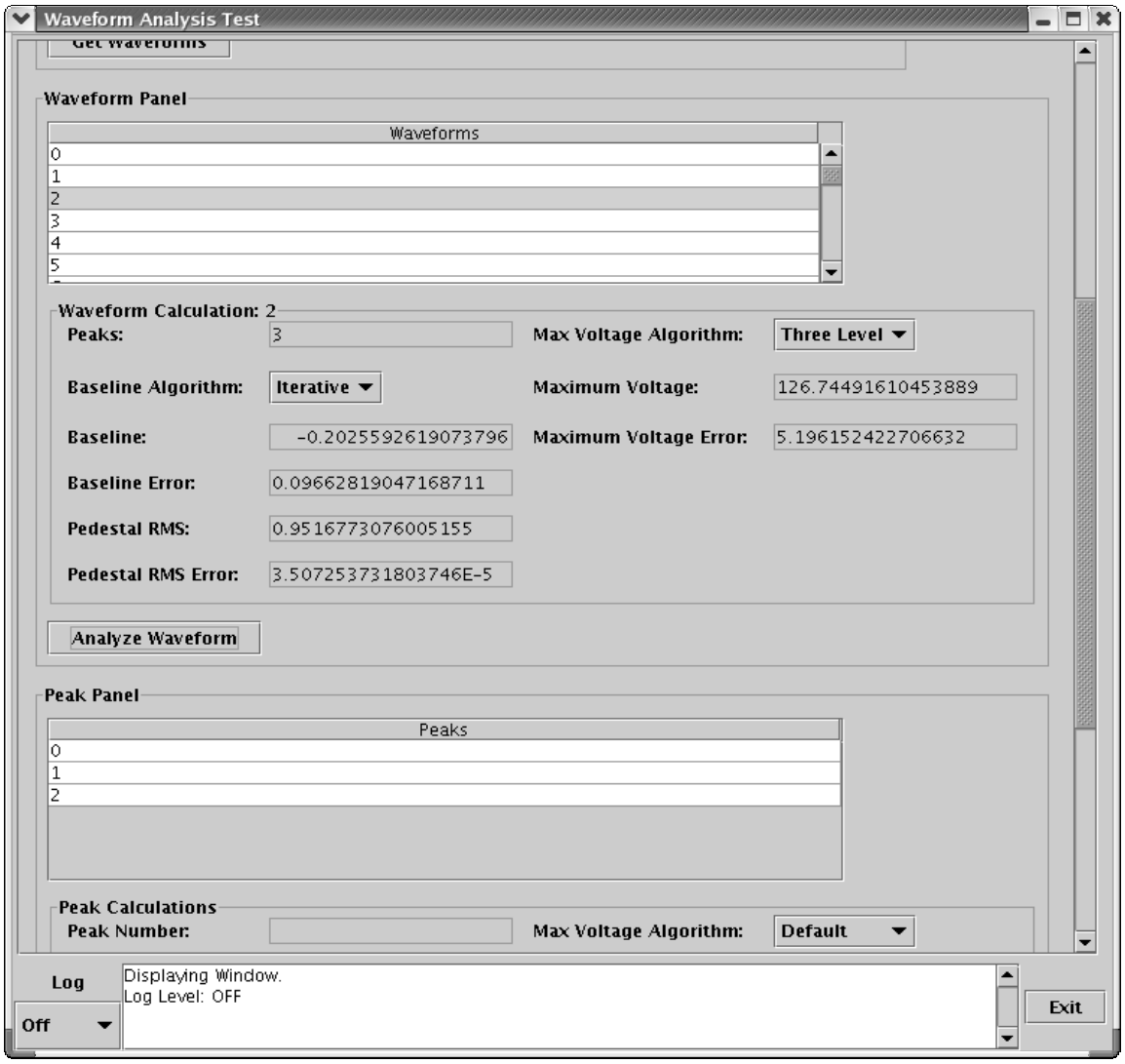


Simulator will be used to fake faulty data.



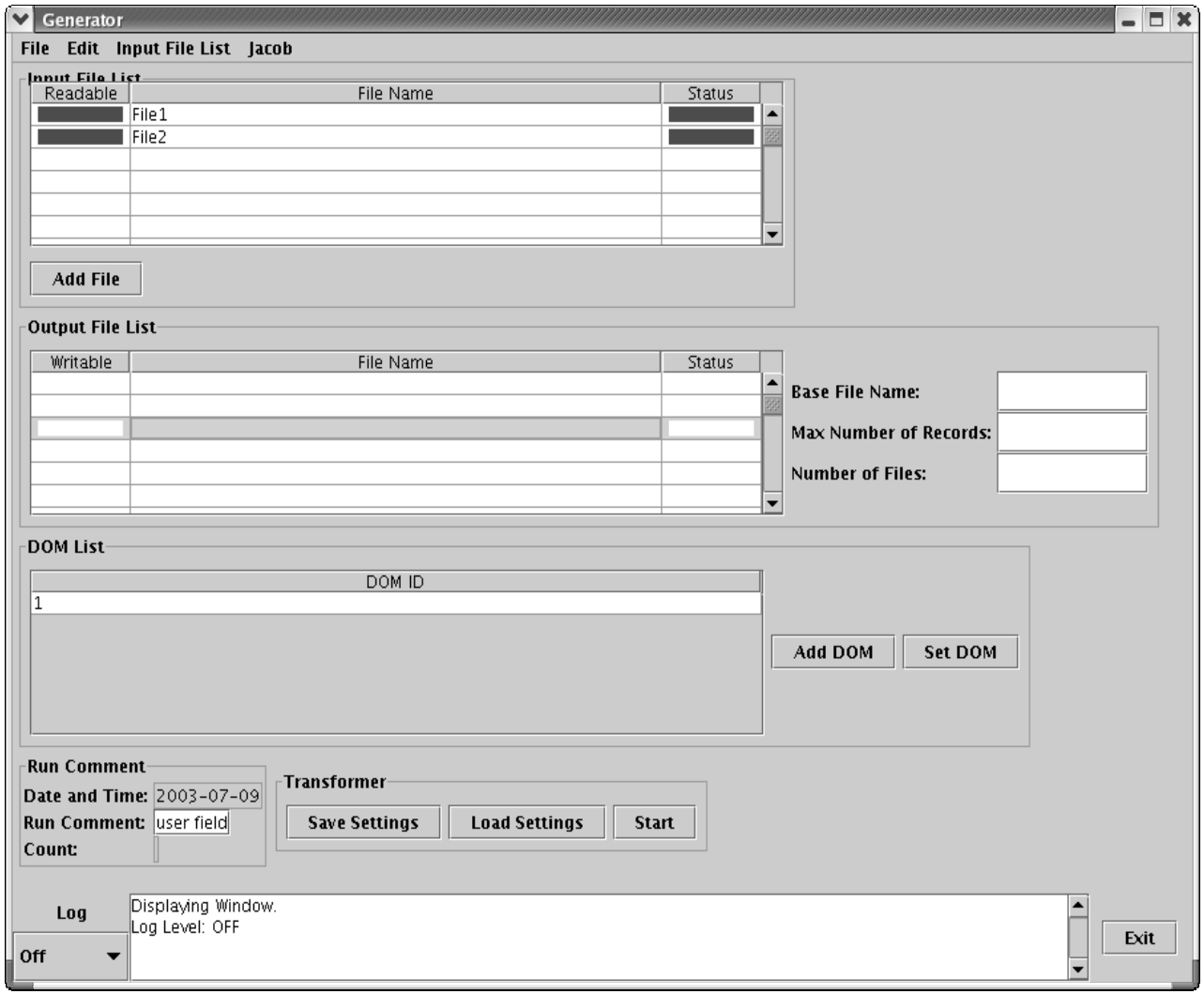
The display package was used to create several tools (1).

Interface for waveform analysis.



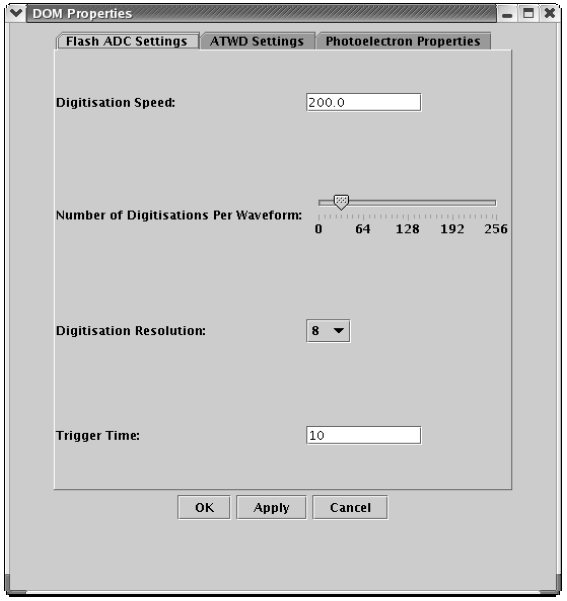
The display package was used to create several tools (2).

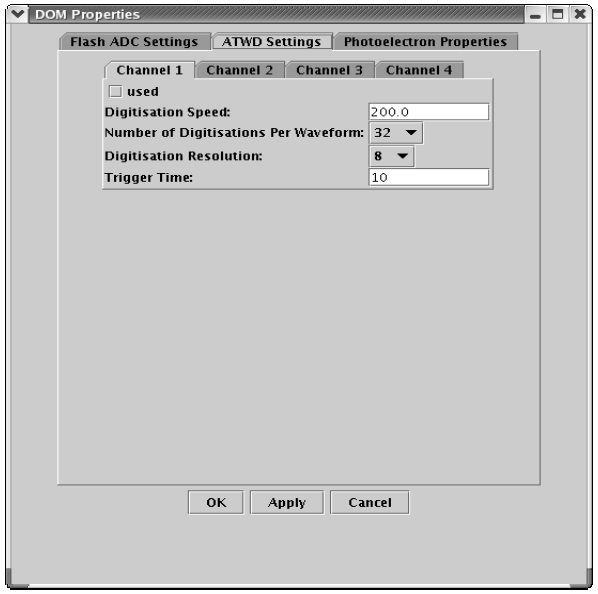
Interface for data simulator.

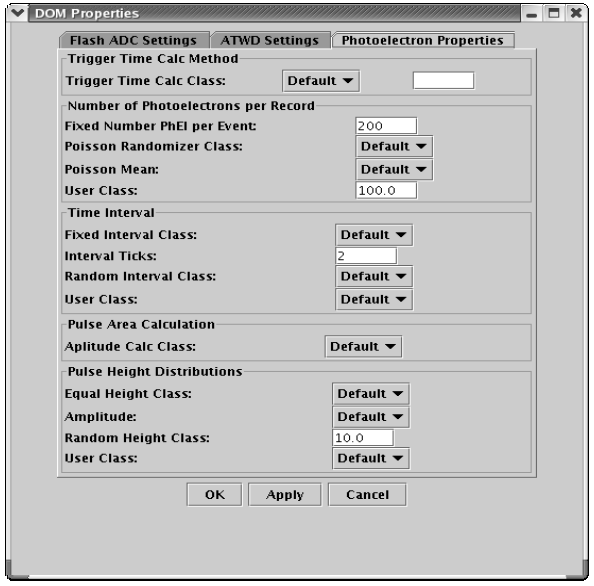


The display package was used to create several tools (3).

Interface to adjust DOM properties.







Summary, outlook.

- Procedure setup in the freezer is converging
- A set of auxiliary tools (osci, mca, simulator) under way
- Versioned data formats under construction
- Release available soon
- Bottlenecks: reader/writer with versioning
  no hardware to play with (adds a lot of motivation)
- Need more input about: monitoring
  data basing procedures.